CLAIMS

What Is Claimed Is:

1. A crossed-wire device comprising a pair of crossed wires that form a junction where one wire crosses another at an angle other than zero degrees and at least one connector species connecting said pair of crossed wires in said junction, said junction having a functional dimension in nanometers, wherein said at least one connector species and said pair of crossed wires forms an electrochemical cell.

2. The device of Claim 1 wherein said at least one connector species forms a quantum state molecular switch comprising an electrically adjustable tunnel junction between said two wires.

3. The device of Claim 1 wherein at least one of said two wires has a thickness that is about the same size as said at least one connector species, and over an order of magnitude longer than its diameter.

4. The device of Claim 3 wherein both of said two wires have a thickness that is about the same size as said at least one connector species.

5. The device of Claim 1 wherein both of said two wires have a thickness that ranges from sub-micrometer to micrometer.

6. The device of Claim 1 wherein said junction is a singly configurable or reconfigurable switch.

7. The device of Claim 6 wherein said junction is at least one of elements selected from the group consisting of resistors, tunneling resistors, diodes, tunneling diodes, resonant tunneling diodes, and batteries.

8. The device of Claim 1 wherein each said wire independently comprises a conductor or a semiconductor.

9. The device of Claim 8 further including an insulating layer or a modulation-doped coating on at least one of said wires.

10. The device of Claim 9 wherein said insulating layer comprises an oxide.

11. The device of Claim 8 wherein said semiconductor is internally doped.

12. The device of Claim 1 wherein said at least one connector species comprises a bi-stable molecule.

13. The device of Claim 12 wherein said bi-stable molecule is one that displays a significant hysteresis in its current-voltage curve, obtained either from solution electrochemistry or from current-voltage characteristics in a solid-state junction.

14. A method of fabricating a crossed-wire device comprising a pair of crossed wires which form a junction where one wire crosses another and at least one connector species connecting said pair of crossed wires in said junction, said junction having a functional dimension in nanometers, wherein said at least one connector species and said pair of crossed wires forms an electrochemical cell, said method comprising (a) forming said first wire, (b) depositing said at least one connector species over at least a portion of said first wire, and (c) forming said second wire over said first wire so as to form said junction.

15. The method of Claim 14 wherein said at least one connector species forms a quantum state molecular switch comprising an electrically adjustable tunnel junction between said two wires.

16. The method of Claim 14 wherein at least one of said two wires is formed to a thickness that is about the same size as said at least one connector species, and over an order of magnitude longer than its diameter.

17. The method of Claim 16 wherein both of said two wires are formed to a thickness that is about the same size as said at least one connector species.

18. The method of Claim 14 wherein both of said two wires are formed to a thickness that ranges from sub-micrometer to micrometer.

19. The method of Claim 14 wherein said junction forms a singly configurable or reconfigurable switch.

20. The method of Claim 19 wherein said junction is at least one of elements selected from the group consisting of resistors, tunneling resistors, diodes, tunneling diodes, resonant tunneling diodes, and batteries.

21. The method of Claim 14 wherein each said wire independently comprises a conductor or a semiconductor.

22. The method of Claim 21 further including forming an insulating layer or a modulation-doped coating on at least one of said wires.

23. The method of Claim 14 wherein said at least one connector species comprises a bi-stable molecule.

24. The method of Claim 23 wherein said bi-stable molecule is one that displays a significant hysteresis in its current-voltage curve, obtained either from solution electrochemistry or from current-voltage characteristics in a solid-state junction.

25. A method of operating a crossed-wire device comprising a pair of crossed wires which form a junction where one wire crosses another and at least one connector species connecting said pair of crossed wires in said junction, said junction having a functional dimension in nanometers, wherein said at least one connector species and said pair of crossed wires forms an electrochemical cell, said method comprising biasing both wires at least once with a first voltage sufficient to cause an electrochemical reaction in said connector species and switch its state.

26. The method of Claim 25 wherein said at least one connector species forms a quantum state molecular switch comprising an electrically adjustable tunnel junction between said two wires.

27. The method of Claim 25 wherein at least one of said two wires has a thickness that is about the same size as said at least one connector species, and over an order of magnitude longer than its diameter.

28. The method of Claim 27 wherein both of said two wires have a thickness that is about the same size as said at least one connector species.

29. The method of Claim 25 wherein both of said two wires have a thickness that ranges from sub-micrometer to micrometer.

30. The method of Claim 25 wherein said junction forms a singly configurable switch, which is set by biasing said wires only once, or a reconfigurable switch, which may be set and reset by biasing said wires more than once.

31. The method of Claim 30 wherein said junction is at least one of elements selected from the group consisting of resistors, tunneling resistors, diodes, tunneling diodes, resonant tunneling diodes, and batteries.

32. The method of Claim 25 wherein each said wire independently comprises a conductor or a semiconductor.

33. The method of Claim 32 further including an insulating layer or a modulation-doped coating on at least one of said wires.

34. The method of Claim 25 wherein said at least one connector species comprises a bi-stable molecule.

35. The method of Claim 34 wherein said bi-stable molecule is one that displays a significant hysteresis in its current-voltage curve, obtained either from solution electrochemistry or from current-voltage characteristics in a solid-state junction.

36. The method of Claim 25 wherein said at least one connector species is either oxidized or reduced.

37. The method of Claim 25 further comprising biasing both wires with a second voltage, lower than said first voltage, to sense its state.